

Claims

6 1. A method of administering to patients by injection or infusion a suspension of microparticles homogeneously distributed in an aqueous liquid carrier by means of an injector system comprising a syringe containing said suspension and a power driven piston for injecting said suspension into a patient, ~~characterised~~ ^{comprising} by subjecting the suspension in the syringe to a rotation or rocking motion, thereby maintaining said suspension homogeneous by preventing segregation of the microparticles by gravity or buoyancy, this being without damaging said particles or disturbing their distribution.

0576422 052200 2. The method of claim 1, in which said motion is provided by outside means for imparting motion to said particles, which motion is then transferred to said liquid carrier.

3. The method of claim 1, in which said motion of rocking or rotation is alternated.

4. The method of claim 3, in which said motion is applied along or around the syringe longitudinal or transverse axis.

5. The method of claim 4, in which said motion is provided by subjecting the syringe to continuous or intermittent rotation.

6. The method of claim 5, in which the rotation rate is from 0.5 to 200 rpm.

7. The method of ~~anyone of preceding claims~~ ^{claim 1}, in which said motion is alternating rotation the direction of which is reversed every 30°, 60°, 90°, 180°, 270° or 360°.

8. The method of claim 7, in which the direction is alternated at a frequency of 0.5 Hz, 1.0, Hz, 1.5 Hz, 2.0 Hz, 2.5 Hz, 3.0 Hz or 3.5 Hz.

claim 1

9. The method of ~~anyone of preceding claims~~, in which said motion is carried out stepwise. *K*

10. An injector system for administering to patients by injection or infusion a suspension of microparticles in an aqueous liquid carrier, said system comprising a syringe (22) whose barrel (25) contains said suspension, and automatic electromechanical power means (24, 31, 34) controllably acting on the syringe to inject the suspension into a patient, characterised in that said injector system further comprises means (30a, 30b) for agitating said microparticles in said suspension, said agitation keeping said suspension homogenous by preventing segregation of said particles by gravity or buoyancy without damaging said particles or disturbing their distribution.

11. The injector system of claim 10, in which said means (30a, 30b) for agitating the suspension in the syringe constitute means under motion for supporting the syringe in the system, the effect of said motion applied to the syringe being to agitate the liquid in the syringe barrel.

12. The injector system of claim 11, in which said motion is a rotation.

13. The injector system of claim 10 in which said injection means acting on the syringe include a syringe plunger (26) driven into forward or backward motion by helical screw means (23, 31, 32).

14. The injector system of claim 13, in which the position of the plunger in the syringe is governed by a number of turns of said helical screw means as controlled by said automatic power means (31, 34).

15. The injector system of claim 12, characterized in that said means under rotation are constituted by wheels (13) in contact with the syringe barrel for driving it into consecutive rotation.

16. The injector system of claim 12, in which the syringe rotates alternatively in one and the opposite direction.

17. The injector system of claim 16, in which the angle covered in each alternate rotation is 30°, 60°, 90°, 180°, 270° or 360°.

18. The injector system of claim 11, in which the rotation rate of the syringe is from 0.5 to 200 rpm.

19. The injector system of claim 11, further comprising a fixed laser detector for reading identification marks provided on the syringe.

20. The injector system of claim 10, further comprising safety means for interrupting the injector operation in case of emergency.

21. The injector system of claim 20, in which said security means operate by monitoring the force applied to the syringe during injection, a sudden increase of that force producing a signal for stopping the injector operation.

method of claim 1
22. The ~~injector system of anyone of claims 18-21~~, in which the suspension is a contrast agent for ultrasonic imaging of patients.

method
23. The ~~injector system~~ of claim 22, in which the contrast agent comprises, in suspension in an aqueous liquid carrier, gas filled microvesicles which are either microbubbles bounded by a gas/liquid interface made from dissolved surfactants, or microballoons bounded by a material envelope made of organic polymers, or of di- or tri- glycerides.

method
24. The ~~injector system~~ of claim 23, in which the gas is a pure physiologically acceptable halogenated gas or gas mixture comprising at least one physiologically acceptable halogenated gas.

method
25. The ~~injector system~~ of claim 24, in which the halogenated gas is selected from CF_4 , C_2F_6 , C_3F_8 , C_4F_8 , C_4F_{10} , C_5F_{12} , C_6F_{14} or SF_6 .

method
26. The ~~injector system~~ of claim 24, wherein the gas mixture contains a gas selected from air, oxygen, nitrogen, helium, xenon or carbon dioxide.

method *Claim 23*
27. The ~~injector system of anyone of claims 23-26~~, in which at least one of the surfactants is a saturated phospholipid in a lamellar or laminar form.

method
28. The ~~injector system~~ of claim 27, in which at least one of the phospholipids is a diacylphosphatidyl compound wherein the acyl group is a C_{16} fatty acid residue or a higher homologue thereof.

method
29. The ~~injector system~~ of claim 23, in which the polymer of the membrane is selected from polylactic or

polyglycolic acid and their copolymers, denatured serum albumin, denatured haemoglobin, polycyanoacrylate, and esters of polyglutamic and polyaspartic acids.

30. The ^{method} ~~injector system~~ of claim 29, in which the microballoons are filled with C_3F_8 and the material envelope is made from albumin.

31. The ^{method} ~~injector system~~ of claim 23, in which the microballoons are bounded by saturated triglycerides, preferably tristearine, tripalmitine or mixtures of thereof with other glycerides, fatty acids and biodegradable polymers.

32. The ^{method of claim 1} ~~injector system of anyone of claims 10-31~~, in which the suspension is a contrast agent for CT imaging.

33. The ^{method} ~~injector system~~ of claim 32, in which the contrast agent comprises as a suspension in a liquid carrier phase liposomes filled with an iodinated compound selected from iomeprol, iopamidol, iopentol, iohexol, metrizamide, iopromide, iogulamide, iosimide or ioversol.

34. The ^{method} ~~injector system~~ of claim 33, in which iodine over lipid ratio I/L is 3 or more.

35. Use of the injector system according to anyone of claims 10-34 in imaging of organs, blood vessels and tissues of a mammalian.

36. Use of claim 35, in which the imaging is ultrasonic imaging and the organ is the heart, the brain, the kidneys, the liver.

37. Use of the injector system according to anyone of claims 10-34 in imaging of organs, blood vessels and tissue of a mammalian.

38. Use according to claim 37, in which the imaging is CT imaging and the organ is the liver.